

# *Acquisition of Software Intensive Systems Conference*

---



## *Revitalizing the Software Acquisition Process*

28 January 2003



**Mike Nicol**  
**ASC/EN**  
**937-255-9566**

**[Michael.Nicol@wpafb.af.mil](mailto:Michael.Nicol@wpafb.af.mil)**

---

*Air Force Aeronautical Systems Center, Engineering Directorate*

<b>Report Documentation Page</b>			Form Approved OMB No. 0704-0188	
<p>Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p>				
1. REPORT DATE <b>28 JAN 2003</b>	2. REPORT TYPE	3. DATES COVERED <b>00-00-2003 to 00-00-2003</b>		
4. TITLE AND SUBTITLE <b>Revitalizing the Software Acquisition Process</b>		5a. CONTRACT NUMBER		
		5b. GRANT NUMBER		
		5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)		5d. PROJECT NUMBER		
		5e. TASK NUMBER		
		5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Air Force Aeronautical Systems Center, Engineering Directorate, Wright Patterson AFB, OH, 45433</b>		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)		
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>				
13. SUPPLEMENTARY NOTES <b>presentation at the Conference on the Acquisition of Software-Intensive Systems, January 28-30, 2003.</b>				
14. ABSTRACT				
15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>25</b>
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>	19a. NAME OF RESPONSIBLE PERSON	



# *Outline*

ASC

- n **Our History**
- n **Today's Environment**
- n **Plan for Improvement**
- n **Next Steps**
- n **Conclusions**



# A Decade Ago...

ASC

- n **DoD 5000.2, Part 6-D, Computer Resources**
  - n Computer Resources Life-Cycle Management Plan (CRLCMP), Integrated system development, Software metrics, Software test management, Ada language policy, Software engineering practices
- n **Air Force Regulation (AFR) 800-14, Life Cycle Management of Computer Resources in Systems**
- n **AFMC Pamphlets**
  - n Software IV&V, Software Risk Abatement, Review of Software Requirements and Interface Requirements Specifications, Software Management Indicators, Software Quality Measurement, Software Development Capability Assessment
- n **SAF/AQ Memos**
  - n Software Engineering, Software Maturity Assessment, Ada, Metrics, Software Estimating, Software Reuse, Best Practices, Use of Software Development Capability Evaluation in Source Selection, Etc.



## A Decade Ago... (Cont.)

ASC

- n **Development standards**
  - n DOD-STD-2167/2168, MIL-STD-498, MIL-STD-1803
  - n MIL-STD-882, MIL-STD-490, MIL-STD-499, DOD-STD-1521
- n **Senior software engineer in each program office, supported with additional help, as necessary**
  - n Depending on magnitude of software development effort, program phase, etc.
- n **Air Force Systems Acquisition School training**
  - n Computer Resources Acquisition Course (CRAC)

***In spite of all this, success was not guaranteed...***



# Today...

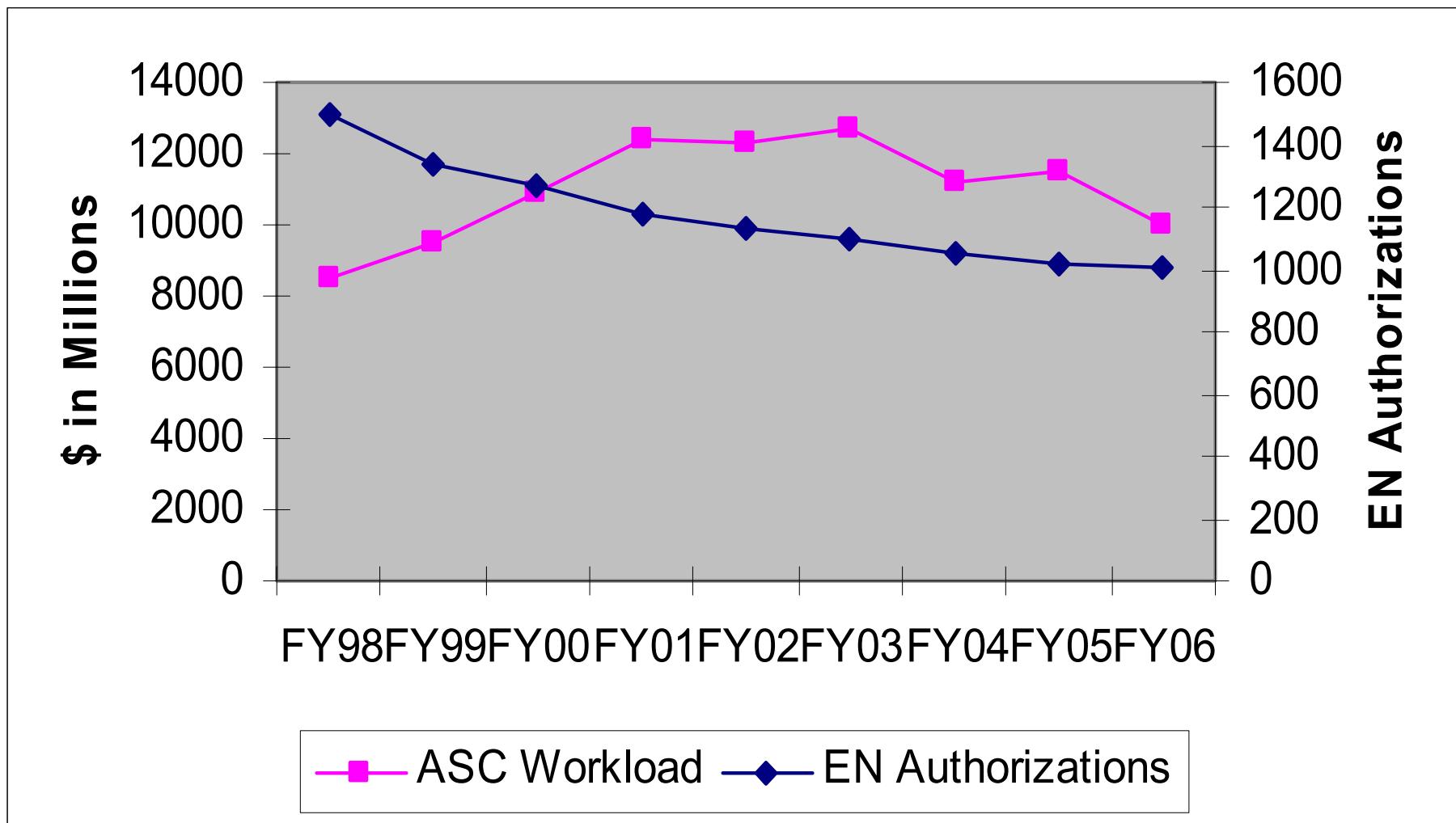
ASC

- n **Limited policy / guidance specific to the acquisition of software intensive systems**
  - n Almost none of it mandatory
- n **No standard way of doing business**
  - n Processes across the acquisition enterprise have diverged
  - n Decreasing oversight / insight
- n **Lack of appreciation for process**
  - n Demands for reduced cycle time
- n **Training available through SAM courses**
  - n Data indicates limited exposure
- n **Aging and diminishing workforce**
  - n 10 year gap for new hires
  - n Acquisition workforce being rapidly downsized



# *ASC Workload and EN Staffing*

ASC





# The Message(s) to PMs...

ASC

The budget is \$x.  
We need the system  
in n months...

Implement software  
acquisition process  
improvements...

Take risks...

Reduce  
cycle times...

Use a disciplined systems  
engineering process...

Be more  
credible...

Transform...

Deliver the  
capability NOW!





# A Sample of Findings from ASC Program Reviews

ASC

- n **Incompatible / optimistic performance, effort, and schedule baselines**
- n **Deficiencies in requirements management**
- n **Inadequate risk identification and management**
- n **Processes set aside due to program pressures**
- n **Planned reuse not achieved**
- n **Program staffing problems**
- n **Failure to identify and react to problems**
- n **Inadequate program office insight**
- n **Labs not fully capable or not in place when needed**
- n **Fixed price development contracts with uncertain requirements or other significant risks**



# An Issue Seen Too Frequently...

ASC

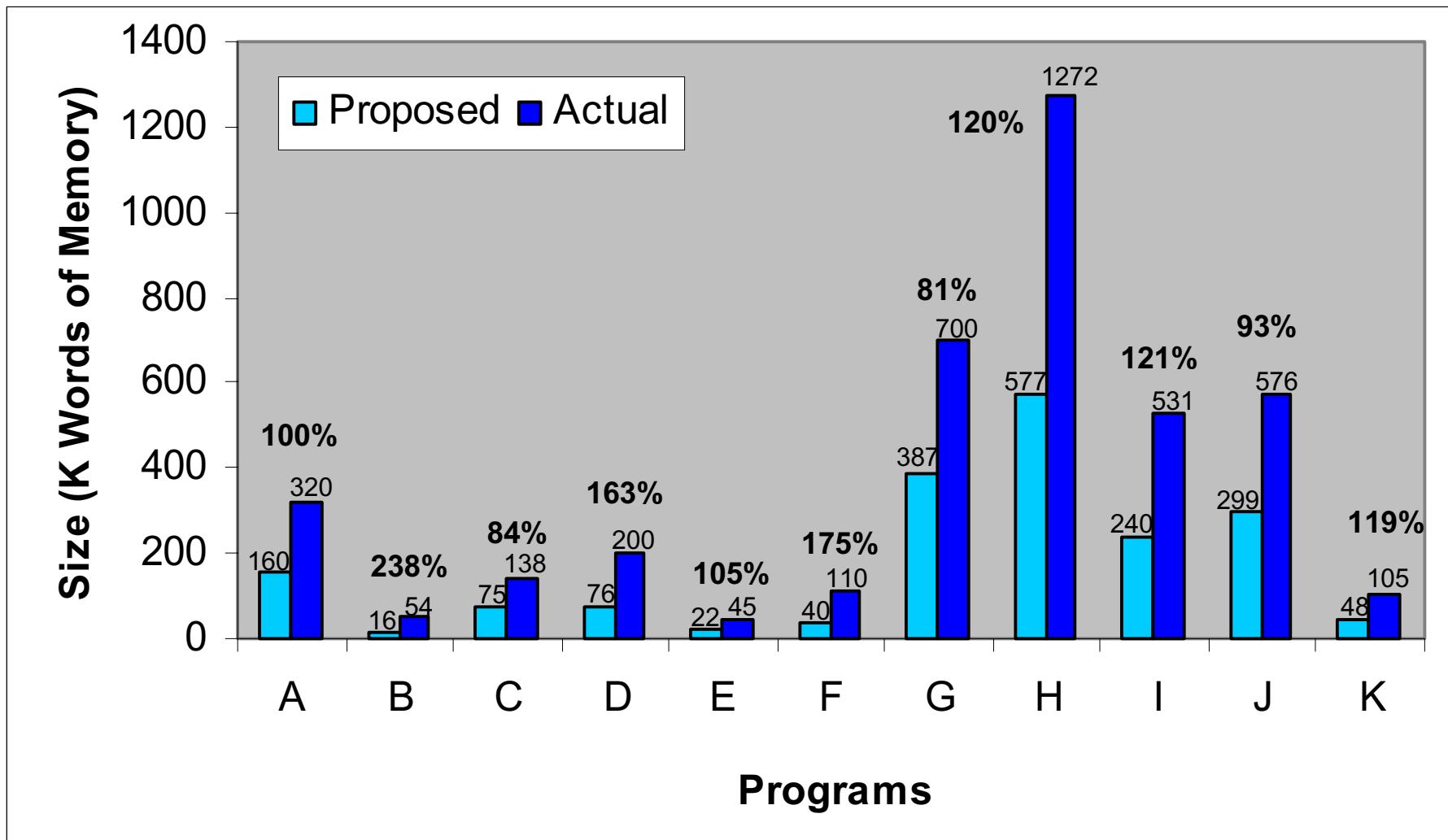
## ***Inability to establish compatible effort, schedule, and performance baselines***

- n **Why?**
  - n Programs come with defined cost, schedule, and performance baselines, often (optimistically) determined without adequate insight into what actually needs to be done
  - n All participants challenged to reduce cycle times, take risks, etc.
  - n Requirements are not fully defined / stable
  - n Difficult to estimate the size of a software development effort for unprecedented systems or where requirements are not complete
    - n Hence, difficult to estimate development effort and schedule
  - n History indicates software size estimate grows significantly during development



# Embedded Software Size Growth

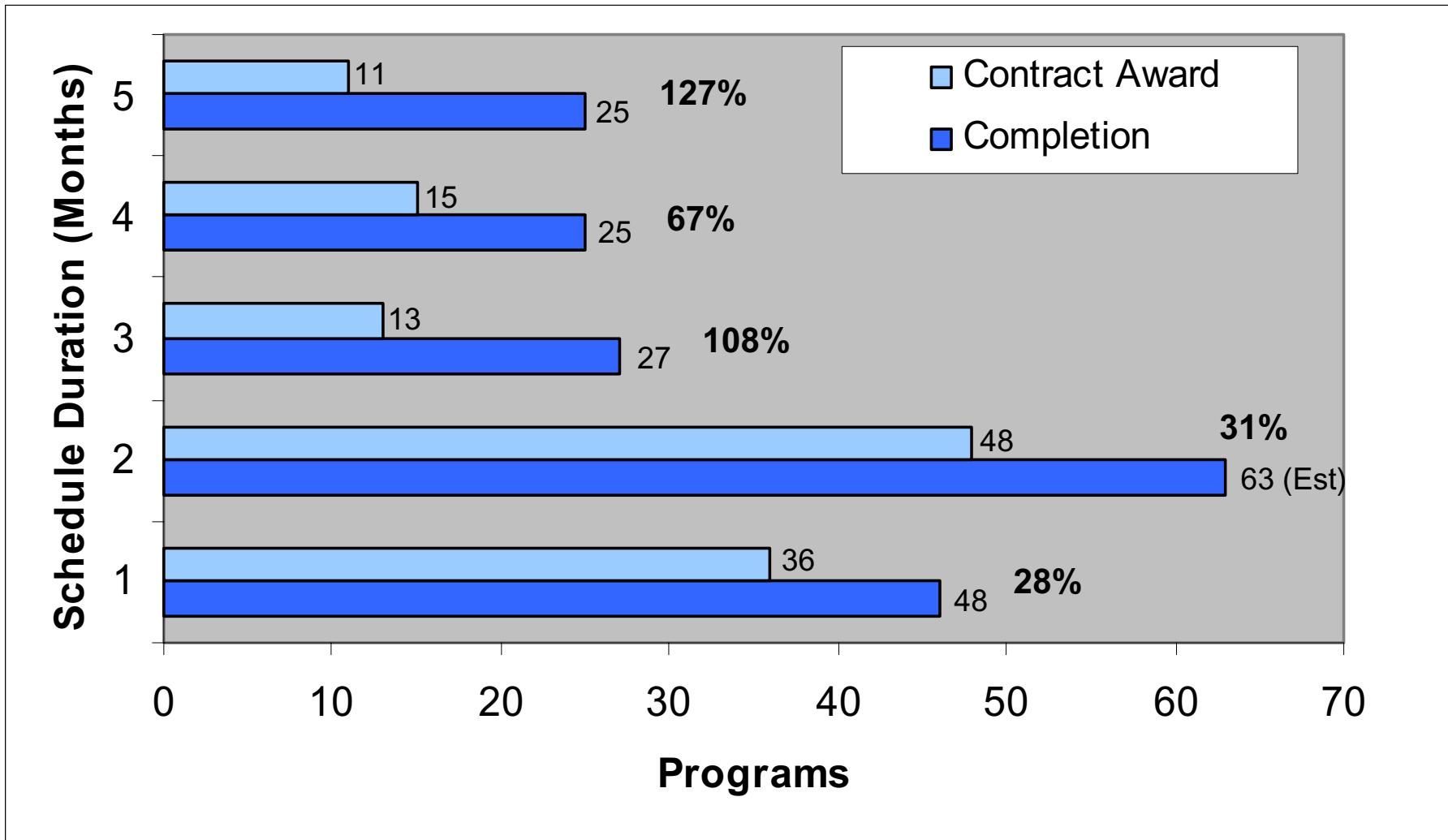
ASC





# Embedded Software Schedule Growth

ASC





## *Plan for Improvement*

ASC

- n **ASC/EN initiative to document and improve systems engineering processes**
  - n Identify, define, & document technical processes
    - n Combine and simplify current processes
    - n Fully integrate internal processes
    - n Focus on government responsibilities
  - n Deploy
    - n Training, guidance, and monitoring
- n **Also considering independent look**
  - n Validation of selected processes by outside organization



# ***Software Acquisition Approach***

ASC

- n **Document critical processes**
  - n Enterprise support activities
  - n Program-level activities (planning and execution)
- n **Develop training**
  - n Target to all who need to know - not just organic engineering
- n **Deploy and monitor application of processes**



# Software Acquisition Approach (Cont.)

ASC

- n **Organization**
  - n Enterprise (Center Level) Support (3)
  - n Acquisition Program Planning Processes (4)
  - n Acquisition Program Execution Processes (14)
- n **Key practices addressed in acquisition strategy**
- n **Each process documented with brief description**
  - n Purpose
  - n Roles and Responsibilities
  - n Key steps
  - n Inputs
  - n Outputs / Products
  - n Available Tools / Techniques
  - n Potential Problem Areas / Pitfalls
  - n Lessons Learned
- n **Appendices with additional detail as needed**



# **Key Software Acquisition Practices**

**(To Be Addressed in Acquisition Strategy)**

ASC

- n **Establish Realistic and Compatible Program Baselines**
- n **Provide System Development and Demonstration (SDD) Phase Source Selection Support**
- n **Identify and Manage Computer System and Software Risks**
- n **Establish and Manage Software Requirements**
- n **Accommodate High-Assurance Systems**
- n **Ensure Application of Mature Development Processes**
- n **Maintain Technical Insight**



# Enterprise Support

ASC

## n **Provide Advice and Counsel**

- n Pre-Acquisition Strategy Panel (ASP) Support
- n Source Selection Consultation and Advice
- n Ensure achievable baselines
- n Program Execution
- n Independent Reviews

## n **Manage Software Acquisition Training and Experience**

- n Software Acquisition Engineering Training (Guidebook)
- n Software Estimation Training
- n Other special-topic training as required

## n **Collect and Disseminate Lessons Learned**

- n Collect lessons learned at project/build completion
- n Establish and maintain lessons learned database
- n Disseminate lessons learned through briefings, training, etc.
- n Implement needed process improvements



# **Acquisition Program Planning**

ASC

## **3.1 Develop Software Acquisition Strategy**

- „ Develop program approach to key software acquisition practices
- „ Get informal, independent review prior to issuing RFP

## **3.2 Establish Realistic, Compatible Program Baselines**

- „ Estimate software development size (factoring in growth)
- „ Estimate software development effort and schedule
- „ Develop realistic estimate that balances risk, cycle time, etc.

## **3.3 Support Request for Proposal (RFP) Preparation**

- „ Provide key software considerations for RFP Sections L and M
- „ Solicit and evaluate software size, effort, and schedule estimates
- „ Solicit software development process documentation

## **3.4 Provide Source Selection Support**

- „ Evaluate developer capability
- „ Evaluate proposed development processes
- „ Evaluate proposed development plan
- „ Assess compatibility of processes, plan, effort, and schedule



# *Program Level Execution*

ASC

## **4.1 Identify and Manage Software-Related Risks**

- „ Ensure effective risk management process is in place
- „ Ensure all software-related risks are identified and managed

## **4.2 Establish and Manage Software Requirements**

- „ Ensure software requirements are defined, complete, verified, consistent and traceable

## **4.3 Address Training System Concurrency Requirements**

- „ Provide for the most efficient method to meet training system concurrency requirements

## **4.4 Establish Software Build Plan**

- „ Ensure there is a plan to define, develop, integrate, and deliver software increments in response to system requirements



## *Program Level Execution (Cont.)*

ASC

### **4.5 Accommodate Application and Sustainment of Non-Developmental Software (NDS)**

- „ Address COTS and other NDS integration

### **4.6 Accommodate Security Certification & Accreditation (C&A)**

- „ Ensure that confidentiality, integrity, and availability is maintained throughout the life-cycle of the system
- „ Preclude compromise, exploitation, sabotage, and intentional damage and destruction

### **4.7 Accommodate Safety-Critical and High-Assurance Systems**

- „ Define the process, including what is expected of the developer, to specify, design, develop, integrate, and verify flight-critical and safety-critical systems



# *Program Level Execution (Cont.)*

ASC

## **4.8 Establish System / Software Engineering Environment (S/SEE) and Development and Integration Laboratories**

- „ Ensure development, integration, and verification environment requirements are fully defined
- „ Ensure environments are in place when needed and can provide the required throughput

## **4.9 Ensure Application of Mature Development Processes**

- „ Assess developer team process capability prior to contract award to identify strengths, weaknesses, and risks
- „ Support disciplined application of processes throughout the development effort



## ***Program Level Execution (Cont.)***

**ASC**

### **4.10 Maintain Technical Insight and Resolve Development Issues**

- n Implement effective means of communication on program status and issues
- n Take corrective action when necessary

### **4.11 Establish Software Product Engineering Data**

- n Ensure the minimum set of engineering data and documentation required for the weapon system software is developed, acquired (or escrowed), and maintained

### **4.12 Conduct / Support Technical Reviews**

- n Determine the types of reviews to be accomplished and the role of the acquisition organization
- n Establish relevant entry and exit criteria



## ***Program Level Execution (Cont.)***

ASC

### **4.13 Plan for Post Deployment Software Support**

- n Identify source of support for all software elements
- n Determine expected rates of change and expected workload
- n Establish required support resources and facilities

### **4.14 Identify and Collect Lessons Learned**

- n Survey project participants
- n Collect objective data
- n Share the results



# *Process Development Schedule*

ASC

- n **Complete guidebook draft** January 2003
- n **Complete coordination and review by SPOs and AFMC SISSG members** February 2003
- n **Publish guidebook Version 1** February 2003
- n **Complete development of guidebook training** March 2003



# Next Steps

ASC

- n **Consider extending scope to AFMC**
  - n Address concerns of other domains
  - n Add sustainment processes
- n **Get leadership buy-in**
- n **Work with Air Force Institute of Technology (AFIT) to enhance training**
  - n Software Professional Development Program (SPDP)
  - n Acquisition-specific training
- n **Address Section 804 requirements**
- n **Incorporate improvements identified by independent process validation activities**



# Conclusions

ASC

- n **We understand the issues and are taking positive steps to set programs up to succeed**
- n **Revitalizing our processes is a crucial first step**
- n **We can't solve the problem by ourselves**
  - n Balance risk and credibility
  - n Support disciplined application of processes